

Serial No.: 10/527,125
Art Unit: 2425

Docket PU020419
Customer No. 24498

Listing and Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

1 (Previously presented) A method for transmitting a plurality of pre-coded programs having different bit rates across a fixed bandwidth channel, comprising the steps of:

generating at least two different bit rate representations of each program, said generating further comprising generating for each program a lowest bit rate representation having a peak bit rate not greater than C/P where C is the total channel capacity in time T and P is the total number of programs;

providing control information at each of a plurality of successive time windows T for each representation of each program, the control information for each successive window indicating a bit rate and quality measure for a representation of a corresponding program; and

during each time window T , selecting a representation for each program such to maximize the quality of the selected representations while not exceeding a total available capacity for the channel.

2. (Canceled)

3. (Original) The method according to claim 1 wherein the step of providing the control information further comprises the step of establishing the peak signal-to-noise ratio (PSNR) as the quality measure embodied in the control information.

4. (Original) The method according to claim 1 wherein the selecting step further comprises the step of selecting a representation for each program which meets the

constraint $\sum_{p=0}^{P-1} r[p, n[p]] \leq C$ for all time windows wherein:

C is the total channel capacity available in time frame T ;

P is the total number of programs;

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$p \in (0, P-1)$, is the index of a particular program;
 $N[p]$ is the total number of representations of program p ;
 $n[p] \in (0, N[p]-1)$ is the index of a particular representation of program p ; and
 $r[p, x]$ is the bit rate of representation x of program p during T .

5. (Original) The method according to claim 4 further comprising the step of choosing each program's representation $n[p] \in (0, N[p]-1)$ to maximize the quality of the program p that had the minimum quality.

6. (Original) The method according to claim 5 further comprising the steps of:

- (a) sorting the quality information for with the bit rate and quality measure monotonically increasing with an index value;
- (b) storing each bit rate increment (delta) and quality value for each index value;
- (c) beginning with a lowest index value, computing total capacity S for program representations selected thus far for such index value;
- (d) selecting a program representation at a lowest quality measure;
- (e) checking whether the bit rate increment of the selected program at the lowest quality, when added to the representations selected thus far, exceeds total channel capacity, and if not
- (f) incrementing the index value; and
- (g) repeating steps (c)-(f).

7. (Original) The method according to claim 1 wherein the selecting step further comprises the step of selecting the representation for each program such to maximize a sum of individual program qualities by solving $\max_{n[p]} \sum_{p=0}^{P-1} q[p, n[p]]$ subject to

$$\sum_{p=0}^{P-1} r[p, n[p]] \leq C$$

wherein,

C is the total channel capacity available in time frame T ;

P is the total number of programs;

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$p \in (0, P-1)$, is the index of a particular program;

$N[p]$ is the total number of representations of program p ;

$n[p] \in (0, N[p] - 1)$ is the index of a particular representation of program p ;

$r[p, x]$ is the bit rate of representation x of program p during T ; and

$q[p, x]$ is the quality of representation x of program p during T .

8. (Original) The method according to claim 1 wherein the selecting step further comprises the step of selecting the representation for each program such to maximize a product of individual program qualities by solving

$$\max_{n[p]} \prod_{p=0}^{P-1} q[p, n[p]]; \text{ subject to } \sum_{p=0}^{P-1} r[p, n[p]] \leq C$$

where,

C is the total channel capacity available in time frame T ;

P is the total number of programs;

$p \in (0, P-1)$, is the index of a particular program;

$N[p]$ is the total number of representations of program p ;

$n[p] \in (0, N[p] - 1)$ is the index of a particular representation of program p ;

$r[p, x]$ is the bit rate of representation x of program p during T ; and

$q[p, x]$ is the quality of representation x of program p during T .

9. (Original) The method according to claim 8 further comprising the step of applying a weighted average to provide different classes of service for different viewers.

10. (Previously presented) A system for transmitting a plurality of pre-coded programs having different bit rates across a fixed bandwidth channel, comprising the steps of:

means for generating at least two different bit rate representations of each program;

means providing control information at each of a plurality of successive time windows T for each representation of each program, the control information for each successive window indicating a bit rate and quality measure for a representation of a corresponding program; and

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means for selecting during each time window T a representation for each program such to maximize the quality of the selected representations while not exceeding a total available capacity for the channel, said selecting means generating for each program a lowest bit rate representation having a peak bit rate not greater than C/P where C is the total channel capacity in time T and P is the total number of programs.

11. (Original) The system according to claim 10 wherein the generating means and control information providing means collectively comprise:

a plurality of multirate stream generators, each associated with a corresponding one of the plurality of pre-coded programs.

12. (Original) The system according to claim 10 wherein the generating means and control information providing means collectively comprise:

a multirate video encoder for encoding at least two bit rate representations of each pre-coded program.

13. (Original) The system according to claim 10 wherein the generating means and control information providing means collectively comprise:

a multirate video encoder for encoding at least two bit rate representations of each pre-coded program; and

a plurality of transport packetizers, each serving to packetize the bit rate presentations for each pre-coded program.

14. (Original) The system according to claim 10 wherein the selecting means includes a static multiplexer.

15. (Original) The system according to claim 12 wherein the selecting means comprises:

a static multiplexer; and

a transport packetizer for packetizing the selecting representation.

16. (Canceled)

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17. (Original) The system according to claim 10 wherein control information providing means establishes quality measure in accordance with a peak signal to-noise ratio (PSNR).

18. (Original) The system according to claim 10 wherein the selecting means selects a representation for each program which meets the constraint $\sum_{p=0}^{P-1} r[p, n[p]] \leq C$ for all time windows where.

C is the total channel capacity available in time frame T ;

P is the total number of programs;

$p \in (0, P-1)$, is the index of a particular program;

$N[p]$ is the total number of representations of program p ;

$n[p] \in (0, N[p]-1)$ is the index of a particular representation of program p ; and

$r[p, x]$ is the bit rate of representation x of program p during T .

19. (Original) The system according to claim 18 wherein the selecting means chooses each program's representation $n[p] \in (0, N[p]-1)$ to maximize the quality of the program p that had the minimum quality.

20. (Original) The system according to claim 10 wherein the selecting means selects the representation for each program such to maximize a sum of individual program qualities by solving:

$$\max_{n[p]} \sum_{p=0}^{P-1} q[p, n[p]]; \text{ subject to } \sum_{p=0}^{P-1} r[p, n[p]] \leq C$$

where,

C is the total channel capacity available in time frame T ;

P is the total number of programs;

$p \in (0, P-1)$, is the index of a particular program;

$N[p]$ is the total number of representations of program p ;

$n[p] \in (0, N[p]-1)$ is the index of a particular representation of program p ;

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$r[p, x]$ is the bit rate of representation x of program p during T ; and
 $q[p, x]$ is the quality of representation x of program p during T .

21. (Original) The system according to claim 10 wherein the selecting means selects the representation for each program such to maximize a product of individual program qualities by solving:

$$\max_{n(p)} \prod_{p=0}^{P-1} q[p, n[p]]; \text{ subject to } \sum_{p=0}^{P-1} r[p, n[p]] \leq C$$

where,

C is the total channel capacity available in time frame T ;

P is the total number of programs;

$p \in (0, P-1)$, is the index of a particular program;

$N[p]$ is the total number of representations of program p ;

$n[p] \in (0, N[p]-1)$ is the index of a particular representation of program p ;

$r[p, x]$ is the bit rate of representation x of program p during T ; and

$q[p, x]$ is the quality of representation x of program p during T .

22. (Original) The system according to claim 10 wherein a weighted average is applied to provide different classes of service for different viewers.